

CLAIMS

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1. A semiconductor device, comprising:
 a bumped device having a plurality of conductive bumps formed thereon;
 a substrate having a plurality of contact pads distributed thereon and approximately aligned with the plurality of conductive bumps; and
 an anisotropically conductive layer disposed between and mechanically coupled to the bumped device and to the substrate, the anisotropically conductive layer electrically coupling each of the conductive bumps with a corresponding one of the contact pads.

2. The semiconductor device of claim 1 wherein the bumped device comprises a bumped die having a plurality of solder bumps formed thereon and the contact pads comprise substantially flat contact pads.

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3. The semiconductor device of claim 1 wherein the substrate includes a plurality of pockets disposed therein, the contact pads being at least partially disposed within the pockets and the conductive bumps being at least partially engaged within the pockets.

4. The semiconductor device of claim 1 wherein the substrate includes a plurality of pedestals disposed thereon, the contact pads being at least partially disposed on the pedestals.

5. The semiconductor device of claim 1 wherein the anisotropically conductive layer comprises a thermosetting anisotropically conductive adhesive.

6. The semiconductor device of claim 1 wherein the anisotropically conductive layer comprises a thermoplastic anisotropically conductive adhesive.

7. The semiconductor device of claim 1 wherein the anisotropically conductive layer comprises a suspension material having a plurality of conductive particles.

8. The semiconductor device of claim 7 wherein at least some of the conductive particles are engaged into contact to form a conductive path between each conductive bump and the corresponding one contact pad.

9. An apparatus for testing a bumped device having a plurality of conductive bumps, comprising:

a substrate including a first surface having a plurality of contact pads distributed thereon, the contact pads being substantially alignable with the plurality of conductive bumps; and

an anisotropically conductive layer disposed on the first surface and engageable with the plurality of conductive bumps to electrically couple each of the conductive bumps with a corresponding one of the contact pads.

10. The apparatus of claim 9 wherein the anisotropically conductive layer includes a flexible outer surface engageable with the plurality of conductive bumps.

11. The apparatus of claim 9 wherein the anisotropically conductive layer includes a resilient outer surface engageable with the plurality of conductive bumps.

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engaging the plurality of conductive bumps and the plurality of contact pads with the anisotropically conductive layer to electrically couple each of the conductive bumps with a corresponding one of the contact pads.

22. The method of claim 18 wherein forming an anisotropically conductive layer between the conductive bumps and the contact pads comprises heating a volume of thermoplastic anisotropically conductive material, applying the volume of thermoplastic anisotropically conductive material onto the substrate to form a layer on the plurality of contact pads, and cooling the layer.

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engaging the plurality of anisotropically conductive particles with a corresponding conductive layer on the contact pads to form the corresponding

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engaging the plurality of anisotropically conductive particles with a corresponding conductive bumps and the plurality of contact pads

the substrate in the plurality of conductive particles anisotropically conductive particles within the pockets.

isotropically comprises an electric field to

isotropically comprises a plurality

plurality of conductive regions, each region being one of a pair of regions separated by a barrier between the regions, the regions being formed to form a conductive contact

plurality of conductive regions, each region being one of a pair of regions separated by a barrier between the regions, the regions being formed to form a conductive contact

includes a conductive layer

27. The method of claim 18, wherein the substrate includes a plurality of pockets disposed therein and wherein engaging the plurality of conductive bumps and the plurality of contact pads with the anisotropically conductive layer includes at least partially disposing the conductive bumps within the pockets.

28. The method of claim 18, further comprising at least partially curing the anisotropically conductive layer.

29. The method of claim 28 wherein at least partially curing the anisotropically conductive layer comprises heating the layer to 150° C.

30. The method of claim 28 wherein at least partially curing the anisotropically conductive layer comprises cooling the layer to ambient temperature.

31. The method of claim 28 wherein approximately aligning the plurality of conductive bumps with the plurality of contact pads comprises optically monitoring the alignment of the conductive bumps and the contact pads.

32. A method of testing a bumped device having a plurality of conductive bumps, comprising:

engaging a plurality of contact pads with an anisotropically conductive layer;

engaging the plurality of conductive bumps with the anisotropically conductive layer substantially opposite from and in approximate alignment with the plurality of contact pads;

forming a plurality of conductive paths through the anisotropically conductive layer so that each of the conductive bumps is electrically coupled to one of the contact pads; and

applying test signals through at least some of the contact pads and the conductive paths to at least some of the conductive bumps.

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33. The method of claim 32 wherein engaging the plurality of conductive bumps with the anisotropically conductive layer comprises at least partially embedding the conductive bumps within the anisotropically conductive layer.

34. The method of claim 32 wherein engaging the plurality of contact pads with the anisotropically conductive layer comprises contacting the contact pads against a surface of the anisotropically conductive layer.

35. The method of claim 32 wherein forming a conductive path through the anisotropically conductive layer so that each of the conductive bumps is electrically coupled to one of the contact pads comprises compressing the anisotropically conductive layer between the conductive bumps and the contact pads to create a conductive path between each conductive bump and each corresponding contact pad.

36. The method of claim 32 wherein forming a conductive path through the anisotropically conductive layer so that each of the conductive bumps is electrically coupled to one of the contact pads includes at least partially exposing the anisotropically conductive layer to a magnetic field.

37. The method of claim 32, further comprising at least partially curing the anisotropically conductive layer.

38. The method of claim 28 wherein at least partially curing the anisotropically conductive layer comprises forming a flexible outer surface on the anisotropically conductive layer.

39. The method of claim 28 wherein at least partially curing the anisotropically conductive layer comprises forming a resilient outer surface on the anisotropically conductive layer.

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41. The method of claim 32, further comprising disengaging the conductive bumps from the anisotropically conductive layer.

42. The method of claim 32 wherein disengaging the conductive bumps from the anisotropically conductive layer comprises heating the anisotropically conductive layer until the anisotropically conductive layer softens and extracting the conductive bumps from the anisotropically conductive layer.

43. The method of claim 32 wherein disengaging the conductive bumps from the anisotropically conductive layer comprises withdrawing the conductive bumps from against an outer surface of the anisotropically conductive layer.

44. A method of testing a bumped device having a plurality of conductive bumps, comprising:

providing a test carrier having a plurality of contact pads distributed thereon and alignable with the plurality of conductive bumps;

forming an anisotropically conductive layer on the plurality of contact pads;

positioning the bumped device proximate the anisotropically conductive layer so that the plurality of conductive bumps are approximately aligned with the plurality of contact pads;

engaging the plurality of conductive bumps with the anisotropically conductive layer so that each of the conductive bumps is electrically coupled to one of the contact pads; and

the plurality of contact pads.

the method of claim 44 wherein
a plurality of pockets disposed therein
within the pockets, and wherein
the plurality of contact pads
are disposed on the plurality of
the method of claim 44 wherein
a plurality of pedestals disposed thereon

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method of claim 44 where
the anisotropically conductive
layer is electrically coupled to one of the conductive layers
at an outer surface of the array.
the anisotropically conductive particles into contact
with the conductive layer and each corresponding conductive layer.

method of claim 44, further
comprising a conductive layer.

method of claim 42 wherein
the conductive layer comprises forming a conductive layer.
the conductive layer.

method of claim 42 wherein
the conductive layer comprises forming a conductive layer.
the conductive layer.

method of claim 42 wherein
the conductive layer comprises heating the conductive layer
to at least 150° C.

method of claim 44, further
comprising an anisotropically conductive layer.

method of claim 55 wherein
the anisotropically conductive layer comprises
the anisotropically conductive layer
the anisotropically conductive layer

method of claim 44 where
the anisotropically conductive
layer is electrically coupled to one of the conductive layers
at an outer surface of the array.
the anisotropically conductive particles into contact
with the conductive layer and each corresponding conductive layer.

method of claim 44, further
comprising a conductive layer.

method of claim 42 wherein
the conductive layer comprises forming a conductive layer.
the conductive layer.

method of claim 42 wherein
the conductive layer comprises forming a conductive layer.
the conductive layer.

method of claim 42 wherein
the conductive layer comprises heating the conductive layer
to at least 150° C.

method of claim 44, further
comprising an anisotropically conductive layer.

method of claim 55 wherein
the anisotropically conductive layer comprises
the anisotropically conductive layer
the anisotropically conductive layer

method of claim 44 where
the anisotropically conductive
layer is electrically coupled to one of the conductive layers
on at least an outer surface of the array substrate, the method
comprising introducing the conductive particles into contact
with the conductive layer on the array substrate and each corresponding
conductive layer on the array substrate.

method of claim 44, further
comprising forming a conductive layer on the array substrate.

method of claim 42 wherein
the conductive layer comprises forming a conductive layer on the array
substrate.

method of claim 42 wherein
the conductive layer comprises forming a conductive layer on the array
substrate.

method of claim 42 wherein
the conductive layer comprises heating the array substrate to at
least 150° C.

method of claim 44, further
comprising forming an anisotropically conductive layer on the array
substrate.

method of claim 55 wherein
the anisotropically conductive layer comprises forming an anisotropically
conductive layer on the array substrate and an anisotropically conductive layer
on the array substrate.

method of claim 44 where
the anisotropically conductive
layer is electrically coupled to one of the conductive layers
on at least an outer surface of the array substrate, the method
comprising: introducing the conductive particles into contact
with the conductive layer on the array substrate and each corresponding
conductive layer on the array substrate;
method of claim 44, further comprising:
heating the conductive layer
method of claim 42 wherein
the conductive layer comprises forming a conductive layer
on the array substrate.
method of claim 42 wherein
the conductive layer comprises forming a conductive layer
on the array substrate.
method of claim 42 wherein
the conductive layer comprises heating the conductive layer
to at least 150° C.
method of claim 44, further comprising:
heating the anisotropically conductive layer
method of claim 55 wherein
the anisotropically conductive layer comprises:
the anisotropically conductive layer
the anisotropically conductive layer

method of claim 44 where
the anisotropically conductive
layer is electrically coupled to one of the conductive layers
on at least an outer surface of the array substrate, the method
comprising: introducing the conductive particles into contact
with the conductive layer on the array substrate and each corresponding
conductive layer on the array substrate;
method of claim 44, further comprising:
heating the conductive layer
method of claim 42 wherein
the conductive layer comprises forming a conductive layer
on the array substrate.
method of claim 42 wherein
the conductive layer comprises forming a conductive layer
on the array substrate.
method of claim 42 wherein
the conductive layer comprises heating the conductive layer
to at least 150° C.
method of claim 44, further comprising:
heating the anisotropically conductive layer
method of claim 55 wherein
the anisotropically conductive layer comprises:
the anisotropically conductive layer
the anisotropically conductive layer

method of claim 44 where
the anisotropically conductive
layer is electrically coupled to one of the conductive layers
on at least an outer surface of the array substrate, the method
comprising: introducing the conductive particles into contact
with the conductive layer on the array substrate and each corresponding
conductive layer on the array substrate;
method of claim 44, further comprising:
heating the conductive layer
method of claim 42 wherein
the conductive layer comprises forming a conductive layer
on the array substrate.
method of claim 42 wherein
the conductive layer comprises forming a conductive layer
on the array substrate.
method of claim 42 wherein
the conductive layer comprises heating the conductive layer
to at least 150° C.
method of claim 44, further comprising:
heating the anisotropically conductive layer
method of claim 55 wherein
the anisotropically conductive layer comprises:
the anisotropically conductive layer
the anisotropically conductive layer

method of claim 44 where
the anisotropically conductive
layer is electrically coupled to one of the conductive layers
on at least an outer surface of the array substrate, the method
comprising: introducing the conductive particles into contact
with the conductive layer on the array substrate and each corresponding
conductive layer on the array substrate;
method of claim 44, further comprising:
heating the conductive layer
method of claim 42 wherein
the conductive layer comprises forming a conductive layer
on the array substrate.
method of claim 42 wherein
the conductive layer comprises forming a conductive layer
on the array substrate.
method of claim 42 wherein
the conductive layer comprises heating the conductive layer
to at least 150° C.
method of claim 44, further comprising:
heating the anisotropically conductive layer
method of claim 55 wherein
the anisotropically conductive layer comprises:
the anisotropically conductive layer
the anisotropically conductive layer

57. The method of claim 55 wherein disengaging the conductive bumps from the anisotropically conductive layer comprises withdrawing the conductive bumps from against an outer surface of the anisotropically conductive layer.

58. The method of claim 44, further comprising monitoring an output signal from the bumped device through one or more of the conductive bumps and the anisotropically conductive layer to one or more of the contact pads.

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